242A-WP-11-02
January 24, 2002
J. Stuart Searight

Summary:

This Working Paper is a compilation of the Issue Papers listed below. These are all Issue Papers to which WG6 has agreed to final resolutions, but has not yet given final approval to the actual MASPS language. Many of these resolutions are also found in 242A-WP-11-01.

- IP01 "Turn Indication"
- IP02 "Altitude Rate"
- IP04 "Size Characteristic"
- IP06 "Obstacle Types"
- IP12 "CDTI/TCAS"
- IP14 "Navigation Reference Point"
- IP18 "Heading at Vstop"
- IP32 "Capability Class Codes"
- IP35 "Note 7 from Table 3-4"
- IP36 "Simultaneous Parallel Approach Ranges"
- IP37 "Air-referenced Velocity Vector"
- IP38: "On-Ground determination criteria"
- IP39 "Vertical NIC"
- IP41 "Emergency Locator Transmitter"
- IP44 "Data Source Appendix"
- IP46 "Reorganize Table 3-4 to show range-dependency of requirements
- IP47 "Incorporate approach spacing intent example into Appendix M"

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	1
Submission Date	12/27/00
Status (open/closed/deferred)	Rev. A - OPEN
Last Action Date	7/13/01

Short Title for Change Issue:	Turn indication is problematic and should be deleted as a required ADS-B message element.

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Stephen Heppe / ADSI Inc
Section number(s)		Phone	+1 703-589-1522
Paragraph number(s)	2.1.2.2.3	E-mail	steveheppe@adsi-m4.com
Table/Figure number(s)	Table 2-2	Other	

Proposed Rationale for Consideration (originator should check all that apply):	
X	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
X	ASA MASPS
	TIS-B MASPS
X	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
X	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance	X	Functional

Issue Description:

Turn indication is described as turning left, turning right or not turning. Table 2-2 indicates that it is a required message element for roughly half of the indicated applications. However, GPS cannot determine when an aircraft is turning (it cannot differentiate between a turn and a lateral wind gust). Even an FMS may be unable to differentiate between a turn and a lateral wind gust, sideslip, etc. unless the aircraft is operating under full autopilot. If the aircraft is being flown manually, the pilot will be making continual control inputs which could be easily mistaken for the start of a turn (leading to potential false alarms by receiving aircraft). If the aircraft is on full autopilot, TCPs are much more effective and operationally useful.

Originator's proposed resolution if any:

Delete turn indication as a required message element for any application. Originator's preference is to delete turn indication completely from the MASPS. However, it could be retained as an optional element pending future definition (i.e., when a well-defined concept of operation is developed).

Working Group 6 Deliberations:

May 24, 2001: This Issue Paper was discussed by the ad hoc group at their May 2001 meeting. It was agreed that this Issue Paper will be addressed in DO-242A. The proposed resolution will probably be adopted within DO-242A, unless Jonathan Hammer (Mitre/CAASD) can provide analysis or other rational to keep Turn Indication as a required message element. (See action Item 5-10.)

July 13, 2001: This paper was again discussed at the WG6 July meeting. Jonathan Hammer agreed to adopt the proposed resolution to delete Turn Indicators as a required message element. Therefore, the proposed resolution shall be incorporated into DO-242A.

August 30, 2001: At the August WG6 meeting, Stuart Searight was given Action Item 7-14 to determine all MASPS changes necessary to no longer have Turn Indication as a required ADS-B message element.

Working Group 6 Final Resolution:

All instances of Turn Indicator will be removed from the MASPS. This includes the following:

- Section 2.1.2.2 "State Vector" has been removed from DO-242A as part of the report re-organization documented in IP 33.
- Section 2.1.2.2.3 "Airborne Turn Indication" will be removed. This is the section that contained the requirement that read, "An Airborne turn indication shall (R2.1) be designated as turning right, turning left, or not turning."
- The "Turn Indication" row will be removed from Table 2-2 "Summary for Application Needs for Applications Supported by ADS-B". This Table showed Turn Indication as required for Separation Assurance & Sequencing, Flight Path Deconfliction Planning, Simulataneous Approaches, and ATS Surveillance.
- The "Turn Indication" row will be removed from Table 2-4a "Additional and Refined Capabilities Appropriate for ADS-B Supported Sample Scenarios".
- "Turn Indication" will be removed from the first bullet in section 3.2.1.1 "System Level".
- Turn Indication will be removed from Table 3-5 "State Vector Report Definition". (*Note: Table 3-5 is being completed redone as part of the report re-organization documented in IP 33.*)
- In Section 4.0, "Airborne Turn Indication" will be removed from R2.12 as a required State vector Element. (*Note: R2.12 – which is found in 2.1.2.2 - will be deleted in its entirety since 2.1.2.2 is to be deleted as part of the report re-organization documented in IP 33. See first bullet above.*)
- In Section 4.0, R2.26 which reads "An Airborne turn indication shall be designated as turning right, turning left, or not turning", will be deleted. (*See 2nd bullet above.*)

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	4
Submission Date	1/11/01
Status (open/closed/deferred)	Rev. A - OPEN
Last Action Date	8/30/01

Short Title for Change Issue:	Request that ownship's aircraft size characteristic be broadcast.

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Gary Livack / FAA
Section number(s)		Phone	(202) 267-7954
Paragraph number(s)		E-mail	Garret.Livack@faa.gov
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
X	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
X	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance	X	Functional

Issue Description: The attached comment **requesting own aircraft's make and model be broadcast for use in future runway incursion systems and wake vortex modeling** was presented to the SC-186 plenary in reference to the ballot on the 1090 MHz ADS-B MOPS (DO-260). It was agreed that this issue would be deferred from consideration in DO-260 until it was first considered for inclusion in a future revision of the ADS-B MASPS. Included with the attached comment is the official response from working group 3, which was charted with development of DO-260.

Note: As a proposal to consolidate IPs 4, 6, 7, 13, 18, and 19 into a single Issue Paper discussing requested additional ADS-B message elements for various applications and users, Working Paper 242A-WP-5-02 was presented to the ad hoc group at their May 2001 meeting. It was the conclusion of the ad hoc group to not consolidate these Issue Papers so that they could each be addressed as separate issues. 242A-WP-5-02 is available for download from the May meeting materials on the WG6 page at <http://adsb.tc.faa.gov/ads-b/186-subf.htm>

Administrative Action: Issue Papers temporarily named 4a, 4b, and 4c were renumbered on February 13, 2001. This IP (4a) was renumbered IP4. IPs 4b and 4c were renumbered IP18 and IP19, respectively.

Originator's proposed resolution if any: Proposed resolution is attached with comment from DO-260 ballot.

Working Group 6's Planned Solution: The ad hoc group was briefed at their May, 2001 meeting on this issue by Ken Staub. The group agreed that the final resolution to this Issue Paper will be based on the 4-bit aircraft size characteristic solution presented in 242A-WP-5-04.

Working Group 6 Deliberations:

January 24, 2001: Due to lack of completeness or maturity of current Operations Concept, it was agreed by the ad hoc group that IP4a should be deferred for consideration in a later version of DO-242.

May 24, 2001: This Issue Paper was discussed by the ad hoc group at their May 2001 meeting. While this Issue Paper was originally deferred, it was agreed to reopen this Issue Paper, re-title it as "Aircraft size Characteristic" and reference the work presented by Ken Staub in 242A-WP-5-04. This IP will be addressed in Revision A.

July 19, 2001: At the July WG6 meeting, it was agreed that the resolution for this Issue Paper needs to be done in concert with the resolution for IP14, "Certified Navigation Center". AI 6-10: Ken Staub will propose specific text to incorporate this into DO-242A.

August 30, 2001: This Issue Paper was again discussed at the August WG6 meeting. It was agreed that the 4-bit size characteristic originally proposed in 242A-WP-5-04 will be broadcast in on-condition messages whenever a plane in on the ground and that – if the size characteristic is large enough – the position data broadcast will need to be relative to the navigation reference point addressed in IP14. It was also agreed that 242A-WP-5-04 will be incorporated into DO-2342A as an appendix as justification for the 4-bit coding scheme. AI 6-10: Ken Staub will propose specific text to incorporate this into DO-242A. Also, for AI 7-16, Ken and Bill Flathers will propose language that will define when an aircraft is considered on the ground and when it is airborne and the transitions in-between these states and what needs to be broadcast dependant on these states..

Working Group 6 Final Resolution:

The following text is a new subsection that will be added to DO-242A. This material is based on 242A-WP-5-04 and was reviewed by WG6 as part of 242A-WP-8-01, 242A-WP-9-01, and 242A-WP-11-01. Also shown is the row from the Mode Status Report Table which defines Aircraft Size Code as a Mode Status Element. In addition, 242A-WP-5-04 will be converted to an appendix showing analysis and justification for this resolution.

2.1.2.5 Aircraft Size Code

The aircraft size code describes the amount of space that an aircraft occupies. The aircraft size code is not required to be transmitted by all ADS-B participants all of the time. However, it *is* required to be transmitted by aircraft above a certain size, at least while those aircraft are in the airport surface movement area.

The aircraft size code shall (R2.xx) be as described in Table 0. The aircraft size code is a four-bit code, in which the 3 most significant bits (the length code) classify the aircraft into one of eight length categories, and the least significant bit (the width code) classifies the aircraft into a "narrow" or "wide" subcategory.

Each aircraft shall (R2.xx) be assigned the smallest length and width codes for which its overall length and wingspan qualify it.

(*continued on following page*)

Working Group 6 Final Resolution (continued):

Note 1: For example, consider a powered glider with overall length of 25 m and wingspan of 50 m. Normally, an aircraft of that length would be in length category 0. But since the wingspan exceeds 33 m, it will not fit within even the "wide" subcategory of length category 0. Such an aircraft would be assigned length category 3 and width category 1, meaning "length less than 54 m and wingspan less than 52 m."

Each aircraft ADS-B participant for which the length code is 1 or more (length greater than or equal to 30 m or wingspan greater than 33 m) shall (R2.xx) transmit its aircraft size code while it is on the surface. For this purpose, the determination of when an aircraft is on the surface shall be as described in section TBD.

*Note 2: The aircraft size code is reported in the MS (Mode Status) report (section **Error! Reference source not found.**).*

Table 0: Aircraft Size Codes.

Length Code (3 MSBs)			Width (Wingspan) Code (LSB)	
dec.	**binary**	**Length Category**	**Narrow (LSB = 0)**	**Wide (LSB = 1)**
0	0 0 0	L < 30 m	W < 16.5 m	16.5 m ≤ W < 33 m
1	0 0 1	L < 38 m	W < 30.5 m	30.5 m ≤ W < 38 m
2	0 1 0	L < 46 m	W < 38 m	38 m ≤ W < 48 m
3	0 1 1	L < 54 m	W < 42 m	42 m ≤ W < 52 m
4	1 0 0	L < 62 m	W < 51.5 m	51.5 m ≤ W < 65 m
5	1 0 1	L < 70 m	W < 66.5 m	66.5 m ≤ W < 74 m
6	1 1 0	L < 78 m	W < 69.5 m	69.5 m ≤ W < 80 m
7	1 1 1	L ≥ 78 m	W < 84 m	W ≥ 84 m

Table 3.4.3.2: Mode-Status (MS) Report Definition.

	MS Elem. #	Contents [Resolution or # of bits]	Reference Section	Notes
ID	4	Call sign [up to 8 alpha-numeric characters]		
	5	Participant Category [5 bits]		
	6	Aircraft Size Code [4 bits]		[2]

Notes for Table 3.4.3.2:

[2] The aircraft size code (SV element 4) only has to be transmitted by aircraft above a certain size, and only while those aircraft are on the ground. (See section 2.1.2.5 for details.)

ADS-B 1090 MHz Rev A Comments Related to MASPS Changes
RTCA SC-186 WG-3/EUROCAE WG-51 SG-1

#	Comment Author	DO-260 Section	Page	Comment / Rationale	Suggested Resolution
1	Livack (2)	1.3.5.2 Incursion Monitoring 1.3.6 Other Applica-tions	11 11	Reference the various ADS-B surface movement applications. (See RTCA SC – 193, WG-3 airport mapping user requirements document, Appendix section, and Appendix E, DO-242). Suggest make aircraft "make / model" a REQUIRED information set to be transmitted in addition to other parameters already agreed upon. This information is needed to support various airport surface movement applications, noise monitoring, and to support the GA wake vortex modeling application. Intent would be to display an aircraft's silhouette while on the ground and in-flight and / or support a wake vortex alerting algorithm. Display of aircraft silhouette data on a CDTI with alerting is believed to help reduce display clutter. **WG#3 Position:** *Can this information be reliably derived?? Will it cause a bandwidth problems??*	This is a safety critical item. The message set needs to be included in the MASPS and MOPS.

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	6
Submission Date	1/11/01
Status (open/closed/deferred)	Rev. A - Closed
Last Action Date	8/30/01

Short Title for Change Issue:	Broadcasting of information from moving and stationary obstacles in and around airports.

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Gary Livack / FAA
Section number(s)		Phone	(202) 267-7954
Paragraph number(s)		E-mail	Garret.Livack@faa.gov
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
X	Item needed to support of near-term MASPS/MOPS development
	X DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	X UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
X	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance	X	Functional

Issue Description:

The attached comments **requesting the broadcast of location information from moving and stationary obstacles in and around airports** were presented to the SC-186 plenary in reference to the ballot on the 1090 MHz ADS-B MOPS (DO-260). It was agreed that these issues would be deferred from consideration in DO-260 until they were first considered for inclusion in a future revision of the ADS-B MASPS. Included with the attached comments is the official response from working group 3, which was charted with development of DO-260.

Note: As a proposal to consolidate IPs 4, 6, 7, 13, 18, and 19 into a single Issue Paper discussing requested additional ADS-B message elements for various applications and users, Working Paper 242A-WP-5-02 was presented to the ad hoc group at their May 2001 meeting. It was the conclusion of the ad hoc group to not consolidate these Issue Papers so that they could each be addressed as separate issues. 242A-WP-5-02 is available for download from the May meeting materials on the WG6 page at <http://adsb.tc.faa.gov/ads-b/186-subf.htm>

Administrative Action: Added Attachment A on 2/20/01, submitted by Gary Livack which contains discussions on two applications that would require action on this Issue Paper.

Originator's proposed resolution if any:

Proposed resolution is attached with comments from DO-260 ballot.

Working Group 6 Deliberations:

May 24, 2001: This Issue Paper was discussed by the ad hoc group at their May 2001 meeting. It was agreed to change the wording of "fixed obstructions" to "fixed obstacles" in the MASPS. Gary Livack agreed to examine section 2.1.2.1.3 and propose additional aircraft/vehicle categories. [AI 5-15] These items will be addressed in Revision A, however any additions of new message or report elements to better describe various obstructions, however, will be deferred to a future revision.

August 30, 2001: In response to AI 5-15, Gary Livack presented 242A-WP-7-10. After reviewing 242A-WP-7-10 and Section 2.1.2.1.3 "Category", WG6 agreed to replace "Fixed Ground or tethered obstruction" with the following three new categories: fixed or movable point obstacle, fixed or movable cluster obstacle, fixed or barrier point obstacle. Also, the number list will become a bulleted list and the "reserved" items will be removed. These changes to 2.1.2.1.3 will close this Issue Paper and are found in the Working Group 6 Final Resolution section of this Issue Paper.

Working Group 6 Final Resolution:

Section 2.1.2.1.3 "Category" from DO-242 will be moved to Section 2.1.2.4 and renamed "Participant Category" in DO-242A, and contain the following changes as marked below:

2.1.2.4 Participant Category

Aircraft/vehicle category~~, as defined by ICAO[6],~~ shall (R2.1) be one of the following:

- Light aircraft - 7,000 kg (15,500 lbs) or less (ICAO)
- Small (15,500 to 75,000 lbs)
- ~~Medium aircraft - more than (7,000 to 136,000 kgs) (15,500 to 300,000 lbs)~~
- Large (75,000 to 300,000 lbs)
- High-Vortex Large (aircraft such as B-757)
- Heavy aircraft 136,000 kg (300,000 lbs) or more (ICAO)
- Highly maneuverable (> 5g acceleration capability) and high speed (> 400 knots cruise)
- Rotorcraft
- Glider/Sailplane
- Lighter-than-air
- Unmanned Aerial vehicle
- Space/Transatmospheric vehicle
- Ultralight/Hangglider/Paraglider
- Parachutist/Skydiver
- Surface Vehicle - emergency vehicle
- Surface Vehicle - service vehicle
- Point Obstacle (includes tethered balloons)
- Cluster Obstacle
- Line Obstacle

Notes:

1 ICAO Medium aircraft - more than (7,000 to 136,000 kgs) (15,500 to 300,000 lbs) can be represented as either small or large aircraft as defined above.

2: Obstacles can be either fixed or movable. Movable obstacles would require a position source.

ADS-B 1090 MHz Rev A Comments Related to MASPS Changes
RTCA SC-186 WG-3/EUROCAE WG-51 SG-1

#	Comment Author	DO-260 Section	Page	Comment / Rationale	Suggested Resolution
6	Livack (10)	1.3.6 Table 2-9A Table 2-72	11 37 171	Safety issue. Fixed and tethered obstacles, while addressed in general terms in the draft 1090 MOPS, are not addressed well. Additionally, there appears to be no apparent means specified to mark (and thus depict) moving vehicles that create obstructions. Moving obstructions include, for example, vehicles operating on or off hard surface roads on airports, trains operating on railroad tracks immediately adjacent to runway thresholds, and vessels operating on navigable waterways, all of which can create a hazard or obstruction especially on or near airports. **WG#3 Position:** *Beyond reasonable scope of any ADS-B system.*	This is a safety critical item. This message set needs to be included in the MOPS.
7	Livack (11)	1.3.6 Table 2-9A Table 2-72	11 37 171	Safety issue. Catenary and other continuous obstacle depictions are not addressed. There are many other types of obstacles that do not fit well as a point-obstacle depiction, such as tall tree-lines, building clusters, dams, and microwave transmission corridors. These types of obstacles require a more complex message description. Towers supporting catenaries should be depicted and a special representation used for catenaries because the catenary itself may be a significant obstruction. In these cases, catenaries need to be depicted as a linear feature with the adjacent support towers depicted at either end. **WG#3 Position:** *Candidate for Nav database rather than an ADS-B system.*	This is a safety critical item. The message set needs to be included in the MOPS.

Attachment A

This attachment cites two applications mentioned by people outside of the ad hoc group that could take advantage of more specific requirements on the broadcast and display of fixed and moving obstacles with ADS-B broadcast devices.

Item 1: Stuart Searight received the following e-mail from a pilot that flies helicopters in North Sea Offshore Operations. In this e-mail message, the author suggests that ADS-B ground-based devices be used to mark obstructions. (Obstructions in this context are ships and vessels such as floating oilrigs that create a safety of flight situation because conventional charting methods to depict hazards do not work well in their case).

Suggestion: Once again, the ADS-B MASPS group needs to classify what type of obstacles and obstructions need to be marked, then proceed with ensuring that the MASPS supports such usage.

> Hello Mr. Searight,
>
> Looked into the information on TCAS and ADS-B on your web site. Very interesting! In Norway M-ADS is mandatory.
>
> One of the high risk operations flying offshore is the IFR instrument approach to an offshore
> installation. This is not a risky operation when there is only one rig within miles, but the situation is
> quite often that there are three or four drilling rigs within a radius of 7 miles. These rigs move around
> and their positions are not always reported. The problem is how to manage the risk avoiding collision
> with rigs in your approach sector. Unlike the fixed wing world where obstacles are reported and
> minima raised accordingly, offshore pilots have to design their own approach based on certain standards
> and have to rely on wx-radar to clear the area. There is no NOTAM service offshore!
>
> If the drilling rigs offshore had the (ADS-B) transponder that automatically reported their position and
> identification the pilots would always see and avoid the obstacles. They could even be able to plan the
> approach before taking off from home base. This would be a significant step in making the offshore
> operation safer.
>
> Could somebody reflect over the problem and possibly give me some feedback?
>
> Best regards,
> Capt. Torgny Almhjell
> Flight Safety Advisor
> CHC Helikopter Service
> Norway

Item 2: Recently, an individual suggested that the group consider a suggestion to provide airport construction crews operating on airports with a portable “ADS-B suitcase” to alert pilots that there were men and / or equipment on a closed runway/taxiway. This application, too, needs to be considered in the broader context of how will the MASPS accommodate new suggestions / operational.

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	12
Submission Date	1/11/01
Status (open/closed/deferred)	Rev. A - OPEN
Last Action Date	8/30/01

Short Title for Change Issue:	Request that an aircraft's CDTI and TCAS/ACAS capabilities and TCAS/ACAS RA information be broadcast as part of the ADS-B message Mode Status reports.

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Bob Hilb / UPS
Section number(s)		Phone	(502) 359-7396
Paragraph number(s)		E-mail	Bob.hilb@air.ups.com
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
X	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance	X	Functional

Issue Description:

The attached comments **requesting aircraft's CDTI and TCAS/ACAS capabilities and any current TCAS/ACAS RA crosslink information be broadcast as part of the ADS-B message set** were presented to the SC-186 plenary in reference to the ballot on the 1090 MHz ADS-B MOPS (DO-260). It was agreed that these issues would be deferred from consideration in DO-260 until they were first considered for inclusion in a future revision of the ADS-B MASPS. Included with the attached comments is the official response from working group 3, which was charted with development of DO-260.

Originator's proposed resolution:

Proposed resolutions are attached with comments from DO-260 ballot. Also, specific MASPS change proposals related to these topics are found on attachment #2 which was submitted by Capt. Hilb in November, 2000.

Working Group 6 Deliberations:

May 24, 2001: This Issue Paper was discussed by the ad hoc group at their May 2001 meeting. It was agreed that the broadcasting of TCAS and CDTI capability part of this Issue Paper will be addressed in Revision A. However, the request to broadcast TCAS RA information will be deferred unless it can be demonstrated that a mature Operational Concept can be shown. [AI 5-16] Bob Hilb will be asked to brief the group on the work being done on the ACM system.

July 19, 2001: At the July WG6 meeting, this Issue paper was discussed with WG1 during a telecon between the two Working Groups. WG1 (whose chair is the author of this Issue Paper), stated that it was their current position that all that needs to be required of ADS-B is to transmit – when applicable - that the aircraft's ACAS II system is currently issuing a Resolution Advisory. WG6 asked what the receive rate requirements of this information would be. WG1 felt these requirements would be similar to those of the State Vector report, since an ACM system would treat this information as part of the transmitting aircraft's current state. It was agreed that WG4 should be asked to analyze these rate requirements.

August 30, 2001: At the August WG6 meeting, it was agreed to have an on-condition report to transmit the fact that an aircraft currently is experiencing an ACAS II RA. It was further agreed that update rates for this report will be left TBD in DO-242A. These actions will close this Issue Paper for DO-242A.

Working Group 6 Final Resolution:

The following text are new subsections that will replace subsection 2.1.2.4 "Class Code" from DO-242. Also shown is the row from the Mode Status Report Table which defines Capability Class Codes as a Mode Status Element. This material is was reviewed and refined by WG6 as part of reviews of 242A-WP-6-11A, 242A-WP-8-01, 242A-WP-9-01, and 242A-WP-11-01.

2.1.2.9 Capability Class (CC) Codes

Capability class codes are used to indicate the capability of a participant to support engagement in specific operations. Known specific capability class codes are listed below. However, this is not an exhaustive set and provision should be made for future expansion of available class codes, including appropriate combinations thereof:

- CDTI based traffic display capability
- TCAS/ACAS installed and operational
- Service Level of the transmitting A/V
- Other capabilities, to be defined in later versions of this MASPS

2.1.2.9.1 CDTI

The CC code for "CDTI based traffic display capability" shall be set to ONE if the transmitting aircraft has the capability of displaying nearby traffic on a Cockpit Display of Traffic Information (CDTI). Otherwise, this CC code shall be ZERO.

2.1.2.9.2 TCAS/ACAS

The CC code for "TCAS/ACAS installed and operational" shall be set to ONE if the transmitting aircraft is fitted with a TCAS (ACAS) computer and that computer is turned on and operating in a mode that can generate Resolution Advisory (RA) alerts. Otherwise, this CC code shall be ZERO.

2.1.2.9.3 Service Level of Transmitting A/V

At least three bits (eight possible encodings) shall be reserved in the capability class codes for the "service level" of the transmitting ADS-B participant.

#	Comment Author	DO-260 Section	Page	Comment / Rationale	Suggested Resolution
16	Hilb (2)	2.2.3.2.7.2	94	TCAS RA status is needed for CD&R application **WG#3 Position:** *Before finalizing position, WG#3 will discuss further with Bob Hilb as to why he wants coordination data rather than just own A/C's RA data. (Easier for transponder to access??)*	Add new section 2.2.3.2.7.2.8A ME bit 48-49, Message bit 80-81 **"TCAS RA" Subfield in Aircraft Operational Coordination Msg** Add table 2-52A Coding — Meaning 00 — No "TCAS RA" Info available 01 — TCAS is not issuing an RA 10 — TCAS is issuing a don't climb xlink 11 — TCAS is issuing a don't descend xlink Change the following as appropriate: Figure 2-9, Sections 2.2.3.2.7.2.9, 2.2.8.2.1, 2.2.8.2.14, 2.2.5.1.33A, 2.4.3.2.7.2.9, A.4.10
17	Hilb (6)	2.2.3.2.7.3.3.1	98	Table 2-54 – Many of the initial applications depend on the controller and other flight crew knowing if an A/C has an operational CDTI. The CD&R application needs to know if the other A/C has an operational TCAS. **Temporary resolution:** Changed Table 2-54, initially as suggested by Hilb, but further discussion by Jerry Anderson, Vince Orlando and others during the CPR correction phase after Plenary led to a revision of the meanings as published in the initial 1090 MOPS. **WG#3 Position:** *WG#3 agrees this issue needs addressed in DO-242A. Also, WG#3 has revised the table that is in the published MOPS. To read as follows:* Bit 9, 10, 11, 12 — Meaning 0000 — TCAS Not Operational, CDTI Not Operational or unknown 0001 — TCAS Not Operational, CDTI Operational 0010 — TCAS Operational, CDTI Not Operational or unknown 0011 — TCAS Operational, CDTI Operational	Change Table 2-54 as follows: Bit 9, 10, 11, 12 — Meaning 0000 — TCAS and CDTI Operational 0001 — TCAS Operational, CDTI not 0010 — CDTI Operational, TCAS not 0011 — Neither CDTI nor TCAS Operational Change the following as appropriate: 2.4.3.2.7.3.3.1, A.4.11.3, Table A-13

2.1.2.5 ACAS/TCAS Capability Code

The ACAS/TCAS capability code is used to indicate that ACAS/TCAS is installed and operational.

2.1.2.6 ACAS/TCAS RA Information

The ACAS/TCAS RA information is broadcast whenever an aircraft has a RA in progress. The information broadcast shall include the direction of the RA and the address of the aircraft the RA is against (if known). The information will be broadcast as long as the RA is in progress.

2.1.2.~~6~~7 Other Information

The ADS-B system shall (R2. 1) be expandable so as to support information transfer requirements for additional applications not specifically identified in this MASPS.

2.2.3 ADS-B System-Level Performance – ATS Provider Needs for Separation and Conflict Management

Table 2-2 Summary of Information Needs for Applications Supported by ADS-B

Information Element	Aid to Visual Acquisition	Conflict Avoidance and Collision Avoidance	Separation Assurance & Sequencing	Flight Path Deconfliction Planning	Simultaneous Approaches	Airport Surface (A/V to A/V & A/V to ATS)	ATS Surveillance
Identification							
Call Sign[1]	**n/r**	**n/r**	**R**	**R**	**R**	**R**	**R**
Address	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Category	**n/r**	**n/r**	**R**	**R**	**R**	**R**	**R**
State Vector							
Horizontal Position	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Vertical Position	**R**	**R**	**R**	**R**	**R**	**n/r**	**R**
Horizontal Velocity	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Vertical Velocity	**R**	**R**	**R**	**R**	**R**	**n/r**	**R**
Turn Indication	**n/r**	**n/r**	**R**	**R**	**R**	**TBD**	**R**
NUC_P ,NUC_R	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Status and Intent[3]							
Emergency/Priority Status	**n/r**	**n/r**	**n/r**	**n/r**	**n/r**	**n/r**	**R**
TCP[2]	**n/r**	**n/r**	**R**	**R**	**n/r**	**n/r**	**R**
TCP+1[2]	**n/r**	**n/r**	**n/r**	**R**	**n/r**	**n/r**	**R**
Class Code	**R**	**R**	**R**	**R**	**R**	**R**	**R**
ACAS/TCAS Capability Code	**n/r**	**R**	**n/r**	**n/r**	**n/r**	**n/r**	**n/r**
ACAS/TCAS RA Information	**n/r**	**R**	**n/r**	**n/r**	**n/r**	**n/r**	**n/r**
Future Expansion	**R**	**R**	**R**	**R**	**R**	**R**	**R**

3.4.4 Minimum ADS-B Report Requirements for Equipage Classes

Table 3-6 Mode-status Report Definition

Element #	Contents
1	Participant Address (Section 2.1.2.1.2)
2	Call Sign (Up to 8 Alpha-numeric Characters) (Section 2.1.2.1.1)
3	Participant Category (Section 2.1.2.1.3)
4	Surveillance Support Code(Normal/Default) (note 3)
5	Emergency/Priority Status (Section 2.1.2.3.1)
6	Class Codes (Section 2.1.2.4)
7	TCP Latitude (Section 2.1.2.3.2)
8	TCP Longitude (Section 2.1.2.3.2)
9	TCP Altitude (Baro Alt/FL) (Section 2.1.2.3.2)
10	TCP Validity(Section 2.1.2.3.2)
~~10~~11	TTG (Section 2.1.2.3.2)
~~11~~12	Operational Mode Specific Data
~~12~~13	Flight Mode Specific Data (note 4)
~~13~~14	Time of Applicability (Section 2.1.1.4)
15	ACAS/TCAS Capability Code (Section 2.1.2.5)

Table 3-7 TCP+1 On-Condition Report Definition

Element #	Contents
1	Participant Address (Section 2.1.2.1.2)
2	TCP+1 (Lat.) (Section 2.1.2.3.2)
3	TCP+1(Long.) (Section 2.1.2.3.2)
4	TCP+1 Altitude (Baro/FL) (Section 2.1.2.3.2)
5	TCP+1 TTG (Section 2.1.2.3.2)
6	TCP Validity(Section 2.1.2.3.2)
~~6~~7	Time of Applicability (Section 2.1.1.4)

3.5.1.1.3 Flight Mode/Status Data Input Devices

The subsystem shall interface with the onboard data entry mechanisms such as flight deck keyboards/selectors, certified encoded data sources, and logical discrete inputs to provide the subsystem with the following data.

- Own ICAO Address Data and/or special address
    - Own aircraft address data normally refers to the recognized ICAO 24 bit Address which is provided by an external source(see below) as a fixed input not alterable by the crew. However, for some operators desiring anonymity, blocks of 24 bit codes are expected to be available and will require entry for each flight operation.

- Vehicle type code
- Own Flight Identification: the operational flight ID is to be managed by the flight crew
- Own Operational Status Notice: Indicates exceptional operational conditions e.g., hijack, medical emergency, engine out etc. In some cases these data may be crew entered or triggered by on board systems. Mode Information is currently associated with Transponder Air-Ground status of the Aircraft as well as any required or desired annunciation of Emergency Status information. ADS-B support to future automation on other aircraft/vehicles requires expansion beyond present capabilities to meet the operations envisioned in Sections 1 and 2 of this MASPS
- Source participant class codes defining flight-phase capabilities
- ACAS/TCAS operational status and RA information

3.5.2.1.3 Mode/Status Data Input Devices

The subsystem shall interface with the onboard data base or approved data entry mechanisms such as an flight deck keyboards/selectors, certified encoded data sources, and logical discrete inputs to provide the subsystem with the following data.

- Own ICAO Address Data and/or special address: Own aircraft address data normally refers to the recognized ICAO 24 bit Address which is provided by an external source(see below) as a fixed input not alterable by the crew or other operating personnel. However, for some operators desiring anonymity, blocks of 24 bit codes are expected to be available and will require entry for each flight operation.
- Vehicle type code
- Own Operational Status Notice: Indicates exceptional operational conditions e.g., hijack, medical emergency, engine out etc. In some cases these data may be crew entered or triggered by on board systems. Mode Information is currently associated with Transponder Air-Ground status of the Aircraft as well as any required or desired annunciation of Emergency Status information. ADS-B support to future automation on other aircraft/vehicles may require specialized data from these subsystems.
- Source participant class codes defining flight-phase capabilities
- ACAS/TCAS operational status and RA information

Fixed obstacle subsystems, B3, require interface only for data to provide receiving participants with a M/S report sufficient to define obstacle identity, type and operational status information.

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	14
Submission Date	1/11/01
Status (open/closed/deferred)	Rev. A - OPEN
Last Action Date	01/24/02

Short Title for Change Issue:	Use of "Certified Navigation Center" with own position. (ADS-B Navigation Reference Point)

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Rick Cassell / Rannoch Corp.
Section number(s)	J.3.2.2	Phone	
Paragraph number(s)		E-mail	
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
X	MASPS clarifications and correction item
X	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial	X	Clarity		Performance	X	Functional

Issue Description: The attached comments which state that **the 1090 MOPS (DO-260) fails to specify any criteria for giving own position data (latitude and longitude) "with respect to a certified navigation center"** were presented to the SC-186 plenary in reference to the ballot on DO-260. It was agreed that these issues would be deferred from consideration in DO-260 until they were first **reconsidered during development of revision A** of the ADS-B MASPS. Included with the attached comments is the official response from working group 3, which was charted with development of DO-260.

Reference: Issue Paper 25, submitted by Gary Livack requesting that military in-flight refueling operations and other formation flying be added to Appendix E, "Other Applications" is cited by Mr. Livack as a application that will need antenna position or certified navigation center.

Originator's proposed resolution if any: Proposed resolution is attached with comments from DO-260 ballot.

Working Group 6 Deliberations:

January 24, 2001: It was noted that "certified center of navigation" is cited in a non-informative appendix (J). This issue will remain open for consideration in DO-242A. WG#4 will be asked if they foresee their work on the ASA MASPS requiring us to change or expand the information currently in the MASPS. SC-193 and the Military also might comment on the need for this issue to be addressed in DO-242A. (See IP25.) It was also agreed to consolidate comments on the DO-260 ballot from Gary Livack regarding this issue into this IP.

May 24, 2001: This Issue Paper was discussed by the ad hoc group at their May 2001 meeting. It was agreed that the wording on this topic needs to be changed in the MASPS. ("Common Navigation Center" was proposed.) Further work on this topic is being considered by WG4. It was agreed to forward the briefing given by Ken Staub (242A-WP-5-05) on this topic to WG4 for their consideration. It was agreed that this will be addressed in Revision A.

July 19, 2001: At the July meeting it was agreed by WG6 for DO-242A the term "Navigation Reference Point" will be used instead of "Certified Navigation Center" which is found on DO-242. It was also agreed that the resolution of this IP will be closely tied to the resolution of IP04 on aircraft size characteristics.

August 30, 2001: At the August WG6 meeting, "Navigation Reference Point" was replaced with "ADS-B Position Reference Point", and the following definition was agreed to, which will be used in DO-242A::

> ADS-B Position Reference Point: A designated point ~~on an aircraft~~ that is used as a reference for reporting the horizontal components of own-ship position. ¶ The point should be common to type and located along the longitudinal axis, so that all extremities of the aircraft are contained within smallest possible rectangle. (i.e. the center of the smallest rectangle that contains all of the aircraft's extremities and oriented along the longitudinal axis)

It was also agreed that the accuracy of this reference point will not need to be greater than 1 meter and that position will need to be broadcast relative to the ADS-B Position Reference Point when the NAC is 9 or greater.

October 26, 2001: It was agreed at the October WG6 meeting to delete the phrase "on an aircraft" in the first sentence of the definition (shown in red strike-out above), and to place this definition into the same section which discusses aircraft size codes.

Working Group 6 Final Resolution:

Section 2.1.2.6.2 will be added as shown below. (2.1.2.6 is "Position")

2.1.2.6.2 ADS-B Position Reference Point

When NAC_P, the Navigation Accuracy Code for Position (subparagraph **Error! Reference source not found.**) is 9 or greater, the horizontal position sent by an ADS-B transmitting subsystem shall (R2.xx) be the position of the ADS-B position reference point. For aircraft and ground vehicles, this position shall (R2.xx) be the center of the smallest rectangle that contains all the extremities of A/V and is oriented parallel to the longitudinal axis of the A/V. Figure 0 illustrates the location of the ADS-B reference point for an aircraft or ground vehicle.

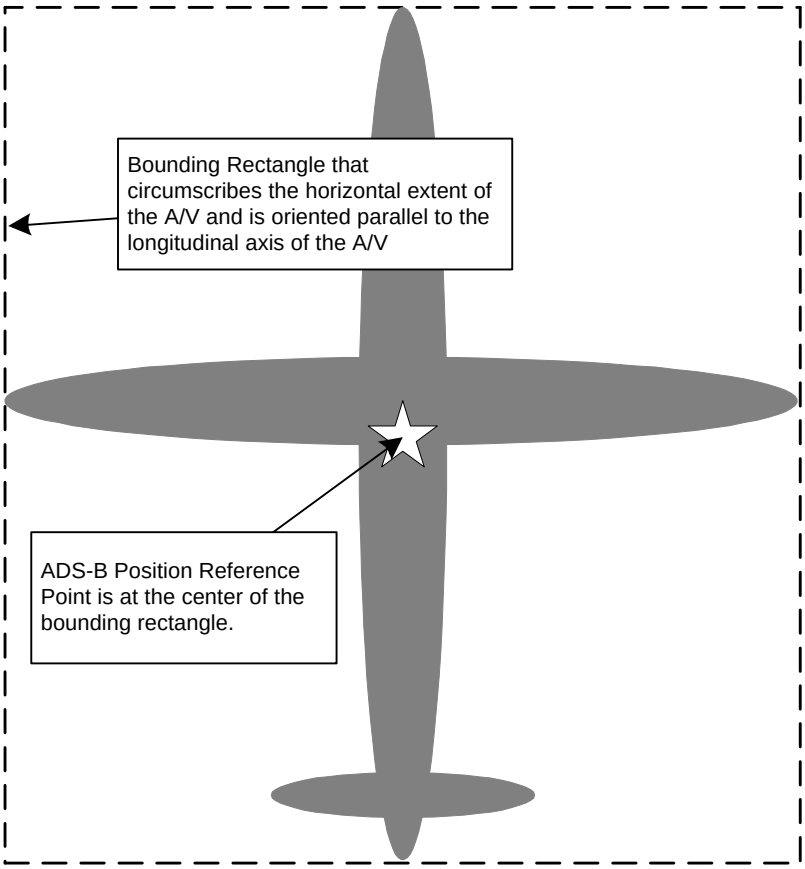

Figure 0: ADS-B Position Reference Point

Note: The accuracy of the location of the ADS-B position reference point with respect to the body of the A/V should be included when determining the NAC_P code to be transmitted from a transmitting ADS-B participant.

ADS-B 1090 MHz Rev A Comments Related to MASPS Changes
RTCA SC-186 WG-3/EUROCAE WG-51 SG-1

#	Comment Author	DO-260 Section	Page	Comment / Rationale	Suggested Resolution
19	Rick Cassell (2)	2.2.5.1.7	121	The ADS-B MASPS indicated that for surface movement requirements, that the [own position latitude] reports are assumed to be given with respect to a "certified navigation center" of the aircraft (DO-242, Section J.3.2.2). This is necessary to ensure meeting the overall accuracy requirements for surface surveillance. The 1090 MOPS fails to specify anything about the reference point for the position information. **Temporary resolution:** Added a new Note after 2.2.5.1.7.c indicating that any application that uses ADS-B surface position information will have to take into account the offset of the information to the navigation reference point. **WG#3 Position:** *Items #19 & 20: WG#3 feels this information would be extremely difficult to include from an installation/airframe standpoint. WG#3 feels that the current buffer for transmitting of antenna is adequate.*	Add language to specify that the encoded latitude is referenced to a nevigation reference point. The recommended options are: 1. The center of the aircraft 2. The nose of the aircraft Note that there should be an associated test specified for this requirement. This should probably be included in Section 3.
20	Rick Cassell (3)	2.2.5.1.8	122	The ADS-B MASPS indicated that for surface movement requirements, that the [own position longitude] reports are assumed to be given with respect to a "certified navigation center" of the aircraft (DO-242, Section J.3.2.2). This is necessary to ensure meeting the overall accuracy requirements for surface surveillance. The 1090 MOPS fails to specify anything about the reference point for the position information. **Temporary resolution:** Added a new Note after 2.2.5.1.8.c indicating that any application that uses ADS-B surface position information will have to take into account the offset of the information to the navigation reference point. **WG#3 Position:** ***See item 19 above.***	Add language to specify that the encoded latitude is referenced to a navigation reference point. The recommended options are: 3. The center of the aircraft 4. The nose of the aircraft Note that there should be an associated test specified for this requirement. This should probably be included in Section 3.
3	Livack (4)	1.3.5.2 Incursion Monitoring 3.3.3 Antenna Location	11 633	Reference the various future surface movement applications. Several of these potential applications will require knowing the exact position (within a few feet) of an aircraft with respect to features on an airport surface. Features in this context include runway hold short markings, penalty box depictions (i.e., "holding" locations), gate areas, etc. So, the issue is how do you establish, then communicate the precise location of an antenna as installed on specific make / model aircraft. **WG#3 Position:** *See item 1 above.*	This is a safety critical item. This item needs to be addressed in the MASPS and MOPS. As FYI, it is believed that the SICASP solution (for Mode S) was to provide a Mode S register function that contained the location of up to four antenna positions with respect to the nose of the aircraft. This data was measured from the nose and included height above the ground, to one meter accuracy. The group needs to ensure that this solution (or an equivalent) is included in the current version of the 1090 MOPS.

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	18
Submission Date	1/11/01
Status (open/closed/deferred)	OPEN
Last Action Date	5/24/01

Short Title for Change Issue:	Request to broadcast own aircraft's heading at Vstop.

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Gary Livack / FAA
Section number(s)		Phone	(202) 267-7954
Paragraph number(s)		E-mail	Garret.Livack@faa.gov
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
X	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
X	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance	X	Functional

Issue Description:

The attached comment **requesting own aircraft's heading at Vstop be broadcast for use in future runway incursion and other surface movement systems** was presented to the SC-186 plenary in reference to the ballot on the 1090 MHz ADS-B MOPS (DO-260). It was agreed that this issue would be deferred from consideration in DO-260 until it was first considered for inclusion in a future revision of the ADS-B MASPS. Included with the attached comment is the official response from working group 3, which was charted with development of DO-260.

Note: As a proposal to consolidate IPs 4, 6, 7, 13, 18, and 19 into a single Issue Paper discussing requested additional ADS-B message elements for various applications and users, Working Paper 242A-WP-5-02 was presented to the ad hoc group at their May 2001 meeting. It was the conclusion of the ad hoc group to not consolidate these Issue Papers so that they could each be addressed as separate issues. 242A-WP-5-02 is available for download from the May meeting materials on the WG6 page at <http://adsb.tc.faa.gov/ads-b/186-subf.htm>

Administrative Action: Issue Papers temporarily named 4a, 4b, and 4c were renumbered on February 13, 2001. This IP (4b) was renumbered IP18. IPs 4a and 4c were renumbered IP 4 and IP19, respectively.

Originator's proposed resolution: Proposed resolution is attached with comment from DO-260 ballot.

Working Group 6 Deliberations:

January 24, 2001: This Issue paper (originally IP4b) was discussed by the ad hoc group at their January 2001 meeting. It was agreed that this issue should be considered for resolution in DO-242A. It was hypothesized that the resolution might be a clarification of the current MASPS. **AI 2-7**: Jim Maynard will propose a MASPS change to resolve this issue.

May 24, 2001: This Issue Paper was discussed by the ad hoc group at their May 2001 meeting. It was agreed that this IP will be addressed in Revision A. Previous action item on this IP [AI 2-7] was closed because it was agreed that it was now superceded by AI 5-6. **AI 5-6**: the team of Jim Maynard, Dan Castleberry, and Richard Barhydt will develop a straw-man proposal to reorganize the State Vector and Mode Status reports to resolve IP33

Working Group 6 Final Resolution:

The following section, which was reviewed by WG6 as part of 242A-WP-6-11A, 242A-WP-9-01, and 242A-WP-11-01, will be added to the MASPS. Also shown is the rows from the State Vector Report table which define Heading as a State Vector Element:

2.1.2.8 Heading

Heading indicates the orientation of the A/V and is described as an angle measured clockwise from true north or from magnetic north. (The heading reference direction is conveyed in the MS report.) If the heading of an A/V is available, it shall (R2.xx) be transmitted while that A/V is on the surface.

To promote ADS-B equipage by as many aircraft as possible, participants are not required to have a heading source available if their aircraft size code (section TBD) is 2 or less. However, ADS-B participants of aircraft size code 3 or above, shall (R2.xx) have a heading source available and shall (R2.xx) transmit messages to support the heading element of the SV report when those participants are on the surface.

Heading occurs not only in the SV report for participants on the airport surface, but also in the On Condition – Air Referenced Velocity (OC-ARV) report for airborne participants. If a transmitting ADS-B participant has heading available, it shall (R2.xx) provide heading in any messages it transmits to support OC-ARV reports.

Table3.4.3.1: State Vector Report Definition.

	SV Elem. #	Contents [Resolution or # of bits]	Required from surface participants	Required from airborne participants	Reference Section	Notes
Heading	8a	Heading while on the Surface [6 bits]		•		
	8b	Heading Valid [1 bit]		•		

ADS-B 1090 MHz Rev A Comments Related to MASPS Changes
RTCA SC-186 WG-3/EUROCAE WG-51 SG-1

#	Comment Author	DO-260 Section	Page	Comment / Rationale	Suggested Resolution
2	Livack (3)	1.3.5.2 Incursion Monitoring	11	Reference various future surface movement applications. Suggest make aircraft "heading at Vstop" a REQUIRED information set to be transmitted while operating on the airport surface. Otherwise, there appears to be no means to correlate heading when not in motion. **WG#3 Position:** *Can this information be reliably derived?? Will it cause a bandwidth problems??*	This is a safety critical item. The message set needs to be included in the MASPS and MOPS.

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B
Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	32
Submission Date	05/22/01
Status (open/closed/deferred)	Rev. A - OPEN
Last Action Date	8/30/01

Short Title for Change Issue:	Revise capability code definition

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	James Maynard
Section number(s)	2.1.2.4	Phone	+1 (503) 391-3281
Paragraph number(s)		E-mail	james.maynard@at.ups.com jhm1jhm@teleport.com jhm1jhm@attglobal.net
Table/Figure number(s)		Other	Fax: +1 (503) 391-3882

Proposed Rationale for Consideration (originator should check all that apply):	
x	Item needed to support of near-term MASPS/MOPS development
	x DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	x UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
x	MASPS clarifications and correction item
x	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial	x	Clarity		Performance		Functional

Issue Description:

The present definition of the "class codes" MS report element in section 2.1.2.4 indicates that this report element indicates the capability of a participant "to support engagement in specific operations," and lists a number of such specific operations, including "collision avoidance," "terminal station keeping," "free flight / cooperative separation in overflight," "oceanic cooperative separation," "simultaneous approaches," "blind taxi," and "runway incursion." This model for the structure of "class codes" seems to require a separate bit for each possible client application, with the set of bits turned on indicating the set of client applications that a transmitting ADS-B participant supports. But a transmitting participant does not necessarily know what will be the requirements of client applications running at different receiving ADS-B participants. It would be better to announce various capabilities of the transmitting participant rather than various applications that it supports.

Administrative Note: For further issue description, please refer to Issue Paper 23. Issue Paper 23 was CLOSED at the May 2001 WG6 meeting because it was determined that this Issue Paper will address all issues related to aircraft capabilities and available ADS-B application functionalities.

Originator's proposed resolution:

I propose that we rename the "class codes" MS report element as "capability codes" or "capability class codes," and that this report element should indicate particular capabilities, or related sets of capabilities, of the transmitting ADS-B participant.

The first "class code" listed in DO-242, §2.1.24, "no application capability," would be the default situation when none of the "capability class" bits are set.

The second "class code" listed in DO-242, §2.1.2.4, "CDTI based traffic display capability," indeed announces a particular capability of the transmitting participant, and is appropriate for inclusion as one of the "capability classes" to be encoded in this MS report element.

Another such capability that has been identified is whether the transmitting participant is equipped with an operating TCAS or ACAS system.

Other capability class codes may be identified and assigned later.

To avoid confusion, the various capabilities for which capability codes are to be assigned should not be assigned numbers in §2.1.2.4, but merely listed as bulleted items. (If an standardized report structure should be specified in the DO-242A MASPS, particular bits could be assigned in that report structure. But that should be the subject of a separate issue paper.)

I propose the following text for §2.1.2.4:

2.1.2.4 Capability Class Codes

Capability class codes are used to indicate the capabilities of a transmitting ADS-B participant, to permit client applications at a receiving ADS-B participant to assess whether data from the transmitting participant meets the requirements of those applications. Known specific capability class codes are listed below. However, this is not an exhaustive set and provision should be made for future expansion of available capability class codes, including appropriate combinations thereof.

- No application capability (e.g., broadcast only)
- CDTI based traffic display capability
- TCAS/ACAS installed and operational
- <other identified capabilities, or sets of related capabilities, to be inserted here>

Working Group 6 Deliberations:

May 24, 2001: The ad hoc group agreed that this Issue Paper will be addressed in Revision A of DO-242.

August 30, 2001: At the August WG6 meeting a proposal of incorporating permissible applications/services into capability classes was discussed. The group agreed that this was beyond what will be addressed for capability codes in DO-242A. It was agreed that Capability Codes would represent equipment capability and not aircraft and/or flight crew capabilities.

Working Group 6 Final Resolution:

The following text are new subsections that will replace subsection 2.1.2.4 "Class Code" from DO-242. Also shown is the row from the Mode Status Report Table which defines Capability Class Codes as a Mode Status Element. This material is was reviewed and refined by WG6 as part of reviews of 242A-WP-6-11A, 242A-WP-8-01, 242A-WP-9-01, and 242A-WP-11-01.

2.1.2.9 Capability Class (CC) Codes

Capability class codes are used to indicate the capability of a participant to support engagement in specific operations. Known specific capability class codes are listed below. However, this is not an exhaustive set and provision should be made for future expansion of available class codes, including appropriate combinations thereof:

- CDTI based traffic display capability
- TCAS/ACAS installed and operational
- Service Level of the transmitting A/V
- Other capabilities, to be defined in later versions of this MASPS

2.1.2.9.1 CDTI

The CC code for "CDTI based traffic display capability" shall be set to ONE if the transmitting aircraft has the capability of displaying nearby traffic on a Cockpit Display of Traffic Information (CDTI). Otherwise, this CC code shall be ZERO.

2.1.2.9.2 TCAS/ACAS

The CC code for "TCAS/ACAS installed and operational" shall be set to ONE if the transmitting aircraft is fitted with a TCAS (ACAS) computer and that computer is turned on and operating in a mode that can generate Resolution Advisory (RA) alerts. Otherwise, this CC code shall be ZERO.

2.1.2.9.3 Service Level of Transmitting A/V

At least three bits (eight possible encodings) shall be reserved in the capability class codes for the "service level" of the transmitting ADS-B participant.

<< Jonathan Hammer or possibly WG-4 to provide definitions of the various service levels.>>

Table 3.4.3.2: Mode-Status (MS) Report Definition.

	MS Elem. #	Contents	[Resolution or # of bits]	Reference Section	Notes
CC	9	Capability Class Codes	[TBD bits]		
		8a:	CDTI display capability		
		8b:	TCAS enabled		
		8c:	Service Level		
		(Reserved for future growth)	[TBD bits]		

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	35
Submission Date	5/16/01
Status (open/closed/deferred)	Rev. A – CLOSED
Last Action Date	1/23/02

Short Title for Change Issue:	Delete or change note 7 of Table 3-4 to assure that this note does not change or supercede the requirements defined in Table 3-4.

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	William Harman
Section number(s)		Phone	(781) 981-3395
Paragraph number(s)		E-mail	harman@ll.mit.edu
Table/Figure number(s)	Table 3-4	Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
X	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial	X	Clarity		Performance		Functional

Issue Description:

Table 3-4 provides a summary of the main technical requirements for ADS-B. In particular, row 4 gives the required values for Nominal Update Period. This row refers to Note 7, which provides a more general statement that combines update period and reception probability. This note was originally intended to provide a flexible way of understanding the requirements in the table.

When the MASPS was developed, an extensive study was done to show the effects of update rate and report probability. This work, which was done mostly by J. Hammer and W. Harman is documented in MASPS Appendix J. Simulation was used for this study, in which ADS-B was modeled simplistically as a periodic transmission with a fixed reception probability. For long-range applications, for example, ADS-B was modeled as a transmission every 12 seconds, with reception probability 0.95. Of course it was recognized that some possible implementations of ADS-B would not follow the simplistic model. Extended Squitter, for example, has a higher transmission rate and lower reception probability. Note 7 was then added to Table 4-3 to indicate that such differences in rate and probability were allowable.

Issue Description (continued):

The problem is that the formula in Note 7 is inconsistent with the values in the table. For example, using the example of long-range surveillance, where the Nominal Update Period in Table 3-4 is 12 seconds, using the formula in Note 7 leads to the following possible values of T and P:

T	P
0.5 sec.	0.09
3 sec.	0.44
12 sec.	0.90

Note that this formula would allow a periodic ADS-B design to transmit at 12 second periods with reception probability of only 90 percent, rather than requiring 95 percent as is stated directly in the Table. This inconsistency was originally not considered to be serious, because it was though that all readers would realize that the values in the Table should prevail.

Originator's proposed resolution if any:

It was noted more recently that some readers of the MASPS are using the values from Note 7, rather than the values from the Table. Therefore, I propose that we correct this inconsistency, and make it clear that the values in the Table are the requirements. One way to correct the inconsistency would be to eliminate Note 7. Alternatively it would be possible to retain Note 7, but change the formula as follows.

7. *Acceptable combinations of report update period (T) and update probability (P) are given by the formula (1 – P)^(TU/T) <= 0.05 where TU is the Nominal Update Period given in the table.*

Working Group 6 Deliberations:

May 24, 2001: The ad hoc group agreed that this Issue Paper will be addressed in Revision A of DO-242.

July 19, 2001: This Issue Paper received much discussion at the July WG6 meeting (see minutes). The final conclusion for a resolution to IP35 at this meeting was to modify Note 7 by removing the formula and explaining that the 99th percentile received report update period is normative. And that other update period/receipt probability ratios could be acceptable subject to analysis. Jonathan Hammer and Steve Heppe were given the action item to find a resolution agreeable to both.

August 30, 2001: It was reported that an agreeable solution could not be found between Jonathan and Steve. They will continue to try to find a solution that makes the requirements consistent and eases the 99% requirement from that defined in Table 3-4. Bill Harman, author of this IP, will also be consulted.

October 26, 2001: At the October WG6 meeting, Jonathan Hammer reported on efforts to resolve this Issue Paper to the satisfaction of Steve Heppe, Bill Harman, and himself. (242A-WP-9-07a) At the time of the meeting, Steve Heppe had not yet responded to Jonathan's final proposal to change Note 7. WG6 reviewed Jonathan's proposed note and – after some minor word-smithing – agreed that note 7 would be changed as proposed by Jonathan, unless Steve objects strongly and with another acceptable solution. Stuart will summarize the final decision of the group and send it to Steve and Bill for final comments [AI 9-14].

(continued on next page)

Working Group 6 Deliberations (continued):

The note agreed to by WG6reads as follows:.
"These standards represent best engineering judgment at the time of publication. Deviation from these standards may be acceptable provided that the applicant demonstrate that all required applications are supported. These requirements will receive additional validation during development of the ASA MASPS."

December 2001 – January 2002: AI 9-14 lead to another round of discussions on this topic. The note proposed – and tentatively agreed to – at the WG6 meeting in October was objected to because they felt it was an "empty" note that merely pushed this issue off to the ASA MASPS and/or a future revision of DO-242.

While it was agreed to by all parties that the original Note 7 should be deleted, it was all agreed to that the update rate requirements for non-ACM use at short ranges were set somewhat arbitrarily and were too stringent. Therefore, a new alternative for Note 7 was proposed and agreed to. It will be referenced in the column labeled "R < 10 NM"[1] and read as follows:

"Requirements for airborne conflict management (ACM) are under development. The 3 second update requirement is the minimum update period required to support ACM for aircraft pairs within 3 nmi and 6000 feet vertical separation that are converging at a rate of greater than 500 feet per minute vertically or greater than 6000 feet per minute laterally. Update rate requirements are once per 5 seconds (95%) for aircraft pairs that are not within these geometrical constraints, i.e., aircraft pairs that are diverging, and for applications other than ACM."

January 29, 2002:

Footnote 1: The columns of Table 3-4 are to be relabeled as per Issue Paper 46)

Working Group 6 Final Resolution:

The replacement for note 7 agreed to by WG6 reads as follows:

> "Requirements for applications for ranges less than 10 nmi are under development. The 3 second update requirement is the minimum update period required to support ACM for aircraft pairs within 3 nmi and 6000 feet vertical separation that are converging at a rate of greater than 500 feet per minute vertically or greater than 6000 feet per minute laterally. Update rate requirements are once per 5 seconds (95%) for aircraft pairs that are not within these geometrical constraints, such as aircraft pairs that are diverging. Requirements for future applications, however, may differ from these requirements."

The above note will be referenced in Table 3-4 in the in the column that is to be labeled "R < 10 NM" as per the agreed upon resolution of IP46 for the rows defining the 95% and 99% requirements. (For a complete view of Table 3-4 with this new Note 7 included, please refer to IP 46.)

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	36
Submission Date	05/21/01
Status (open/closed/deferred)	Rev. A - OPEN
Last Action Date	10/18/01

Short Title for Change Issue:	Simultaneous Parallel Approaches

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Gene Wong
Section number(s)		Phone	202-267-5339
Paragraph number(s)		E-mail	Gene.wong@faa.gov
Table/Figure number(s)	Table 2.4a, Table 3.2-1	Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
X	Item needed for harmonization with international requirements
X	Item identified during recent ADS-B development activities and operational evaluations
X	MASPS clarifications and correction item
X	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity	x	Performance	x	Functional

Issue Description:

Table 2.4a and Table 3-1 contain incorrect surveillance coverage for ADS-B air-to-ground application in the area of simultaneous parallel approaches.

Table 2.4a, under the last column of “Parallel Runway Conform. Mon.” and corresponding to “Operational Domain Radius (nmi)”, MASPS specifies “10”. Similarly, Table 3-1, last column of Ground Receive Subsystem (class C) and corresponding to ATS Parallel Runway, specifies “approach coverage out to 10 nmi”. FAA’s Precision Runway Monitor (PRM) system specification requires the monitoring of simultaneous parallel approaches up to 30 nmi. In specific airports with Air Traffic Service approval, the surveillance range may be relaxed to the point where the aircraft intercepts the final approach course. If ADS-B ground receiver is to perform equivalent PRM surveillance function, it must provide coverage to 30 nmi, or the point where the aircraft intercepts the final approach course.

Originator's proposed resolution if any:

In Table 2.4a, under the last column of "Parallel Runway Conform. Mon." and corresponding to "Operational Domain Radius (nmi)", replace "10" with "30, or the point where the aircraft intercepts the final approach course".

In Table 3-1, Ground Receive Subsystems (class C), last column and corresponding to "ATS Parallel Runway and Surface Operation", replace "approach coverage out to 10 nmi" with "30 nmi, or the point where the aircraft intercepts the final approach course".

Working Group 6 Deliberations:

May 24, 2001: This issue paper was reviewed at the May WG6 meeting, and it was agreed that the tables mentioned in the Issue Paper (Tables 2.4a, and Table 3.2-1) do contain incorrect information. The suggested resolution will be implemented and this Issue Paper will be addressed in Revision A of DO-242.

Working Group 6 Final Resolution:

See attachment A of this Issue Paper.

Table 2-4a Summary of ATS Provider Surveillance and Conflict Management Current Capabilities for Sample Scenarios[a]

	Operational Capability			
Information	En Route	Terminal	Airport Surface	Parallel Runway Conform Mon.
Initial Acquisition of A/V Call Sign and A/V Category	within 24 sec.	within 10 sec.	within 10 sec.	n/a
Altitude Resolution (ft)	25	25	25	25
Horizontal Position Error	388 m @ 200 nmi 116 m @ 60 nmi 35 m @ 18 nmi	116 m @ 60 nmi 35 m @ 18 nmi	3 m. rms, 9 m. bias [15],[6], [11]	9 m.
Received Update Period[b]	12 sec. [10]	5 sec. [6]	1 sec.	1 sec.
Update Success Rate	98%	98%	98% [6]	98%
Operational Domain Radius (nmi)	200	60	5	30, or the point where the aircraft intercepts the final approach course~~10~~
Operational Traffic Densities[c] (# A/V)	1250 [6]	750 [6]	100 in motion; 150 fixed	50 dual; 75 triple; w/o filter: 150
Service Availability[d] (%)	99.999 [10] 99.9 (low alt)	99.999 [10] 99.9 (low alt)	99.999 [10]	99.9

Table 3-1 Subsystem Classes and Their Features

Class	Subsystem	Capability	Features	Comments
Interactive Aircraft/Vehicle Participant Subsystems (Class A)				
A0	Minimum Interactive Aircraft/Vehicle	Aid to Visual Acquisition	Lower Tx power and less sensitive Rx than Class A1 permitted.	Minimum interactive capability with CDTI.
A1	Basic Interactive Aircraft	A0 plus Conflict Avoidance	Standard Tx and Rx	Provides ADS-B based conflict avoidance and interface to current TCAS surveillance algorithms/ display
A2	Enhanced Interactive Aircraft	A1 plus Separation Assurance and Sequencing	Standard Tx power and more sensitive Rx. Interface with avionics source required for TCP data.	Baseline for separation management employing intent information.
A3	Extended Interactive Aircraft	A2 plus Flight Path Deconfliction Planning	Higher Tx power and more sensitive Rx. Interface with avionics source required for TCP and TCP+1 data	Extends planning horizon for strategic separation employing intent information.
Broadcast-Only Participant Subsystems (Class B)				
B1	Aircraft Broadcast only	Supports visual acquisition and conflict avoidance for other participants	Tx pwr may be matched to coverage needs. NAV input required.	Enables aircraft to be seen by Class A and Class C users.
B2	Ground vehicle Broadcast only	Supports visual acquisition and conflict avoidance on airport surface	Tx pwr matched to surface coverage needs. High accuracy NAV input required.	Enables vehicle to be seen by Class A and Class C users.
B3	Fixed obstruction	Supports visual acquisition and conflict avoidance	Fixed coordinates. No NAV input required. Collocation with obstruction not required with appropriate broadcast coverage.	Enables NAV hazard to be detected by Class A users
Ground Receive Subsystems (Class C)				
C1	ATS En route and Terminal Area Operations	Supports ATS cooperative surveillance	Requires ATS certification and interface to ATS sensor fusion system.	En route coverage out to 200 nmi. Terminal coverage out to 60 nmi.
C2	ATS Parallel Runway and Surface Operation	Supports ATS cooperative surveillance	Requires ATS certification and interface to ATS sensor fusion system.	30 nmi, or the point where the aircraft intercepts the final approach course~~Approach coverage out to 10 nmi~~. Surface coverage out to 5 nmi.
C3	Flight Following Surveillance	Supports private user operations planning and flight following	Does not require ATS interface. Certification requirements determined by user application.	Coverage determined by application.

CHANGE ISSUE – RTCA / DO-242A

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	39
Submission Date	5/14/01
Status (open/closed/deferred)	OPEN
Last Action Date	7/19/01

Short Title for Change Issue:	Does the vertical height integrity (NIC) value need to be the same as the horizontal integrity level so suitably equipped aircraft can perform ACM functions against ADS-B equipped TARGET aircraft?

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Gary Livack / FAA
Section number(s)		Phone	(202) 267-7954
Paragraph number(s)		E-mail	Garret.livack@faa.gov
Table/Figure number(s)		Other	livack@worldnet.att.net

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance		Functional

Issue Description:

How might the revised version of the ADS-B MASPS (DO-242A) be drafted so as to ensure that the vertical height integrity value is at the same "level" as the horizontal NIC level so that ACM can be accomplished. If we do not address this interoperability issue now, especially for Capstone 2 avionics, we may end up deploying systems that will not have the adequate vertical height attributes to act as the TARGET aircraft / system for ACM equipped aircraft. What might happen is with many systems deployed, we then might realize that these already deployed systems (e.g., Capstone 2 and future) are not backwards compatible (in vertical NIC) and thus would need to upgrade their systems to be targets for other aircraft equipped with ACM systems.

Originator's proposed resolution if any:

None submitted.

Working Group 6 Deliberations:

May 24, 2001: The ad hoc group agreed that this Issue Paper will be addressed in Revision A of DO-242.

July 19, 2001: During a joint telecon with WG1, it was agreed to provide VPL when available and some bits will be reserved to identify the integrity of non-GPS altitude sources (ex. single barometric with no integrity, or duel altimetry with cross-checking).

Working Group 6 Final Resolution:

The following text are new subsections that will be added to DO-242A. Also shown are the rows from the Mode Status Report Table which define the fields that categorize the quality of barometric altitude data. This material is was reviewed and refined by WG6 as part of reviews of 242A-WP-9-01 and 242A-WP-11-01.

2.1.2.15 Barometric Altitude Quality Code

The barometric altitude quality code is a 2-bit field which shall be ZERO for equipment that conforms to this version (DO-242A) of the ADS-B MASPS.

Note: Non-zero values of the barometric altitude quality code will be defined in future versions of this MASPS. It is expected that the altitude quality code will address characteristics such as: resolution and accuracy, latency, whether the altitude source provides its output as an analog, Gilham coded, or digital output, and whether the altitude source qualifies for usage in RVSM airspace.

2.1.2.16 Altitude Source Cross-Checking Flag

A transmitting ADS-B participant shall set the Altitude Source Cross-Checking Flag to ONE in the messages that it sends to support the MS report only if there is more than one source of barometric pressure altitude data and cross-checking of one altitude source against the other is performed so as to clear the "barometric altitude valid" flag in the SV report if the two altitude sources do not agree. Otherwise, it shall set this flag to ZERO.

Table 3.4.3.2: Mode-Status (MS) Report Definition.

	MS Elem. #	Contents [Resolution or # of bits]	Reference Section	Notes
SV Quality	11	Nav. Acc. Category for Position (NAC_P) [4 bits]		
	12	Nav Acc. Category for Velocity (NAC_V) [2 bits]		
	13	Surveillance Integrity Level (SIL) [2 bits]		
	14	NAC_{baro} [2 bits] (Baro Altitude Quality Code)		
	15	NIC_{baro} (Altitude Cross Checking Flag) [1 bit]		

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	41
Submission Date	06/04/01
Status (open/closed/deferred)	Rev. A - CLOSED
Last Action Date	10/26/01

Short Title for Change Issue:	Emergency Locator Transmitter Functionality

MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Bill Flathers
Section number(s)	Appendix E +	Phone	(703) 883-7578
Paragraph number(s)		E-mail	Bill.Flathers@AOPA.org
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
X	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
X	UAT MOPS
X	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
X	MASPS clarifications and correction item
X	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity		Performance	X	Functional

Issue Description:

The current MASPS briefly mention (in Appendix E and elsewhere) the possible use of ADS-B to aid or replace Emergency Locator Transmitters (ELTs) for GA. While it is acknowledged that the ELT function is not a primary function of ADS-B, there are several recent developments that make it more attractive to the full spectrum of airspace users, and therefore worthy of more comprehensive treatment in the MASPS. First, potentially expensive ELT upgrades are on the horizon for GA as search-and-rescue (SAR) service providers push for technology enhancements to improve performance and reduce SAR costs. Second, there is growing pressure for *all* aircraft, including air-carrier aircraft which are now exempt from the ELT requirement, to be ELT-equipped. This is in response to recent accidents in which an extended period of time had passed before local authorities became aware that an accident had occurred. Also, there is interest in obtaining better position information for accident sites in order to provide more timely and better direction to SAR crews, especially at night and in reduced visibility. Given these factors, it seems appropriate to exploit this function of ADS-B in order to provide additional incentive and benefit for users to equip.

Originator's proposed resolution if any:

Three actions are proposed to address this issue. First is a review of the MASPS to ensure that nothing in the current version effectively negates any potential that ADS-B might have to support this ELT role. It would also be helpful to review available versions of the ADS-B MOPS to see how well these more-focused documents make provision for this role. Second, it would be desirable to establish, through a bona fide concept of operations, what other message elements need to be created to support this application, along with a notional architecture and protocol for making use of them. Finally, this work needs to be captured in the MASPS in a way that lends credence to the viability and potential of the application.

It is important to note that this proposal is *not* an invitation to delve into crash hardening, battery power management, and other ELT issues that are covered in other documents. Nor is it suggested that ELT functionality be part of the minimum requirements for ADS-B. Rather, this proposal is offered simply to provide an attractive option for airspace users to obtain cost-effective and useful ELT functionality.

Ad Hoc Group Deliberations:

August 30, 2001: This Issue Paper was reviewed at the August WG6 meeting. It was agreed this Issue Paper will be addressed in Revision A. The resolution to this Issue Paper will be to define one of the unused Emergency/Priority Status messages in 2.1.2.3.1 for a crash situation and to add some words to Appendix E that an ELT is a potential function supported by ADS-B. (AI 7-10)

Ad Hoc Group Resolution:

The MASPS Changes to Section 2.1.2.3.1 "Emergency/Priority Status" and Appendix E "Other Applications" found in Attachment A will be included in Revision A and CLOSE this Issue Paper.

Changes to section 2.1.2.3.1:

2.1.2.3.1 Emergency/Priority Status

The ADS-B system shall (R2.1) be capable of supporting broadcast of emergency and priority status. Status shall (R2.2) include the following:

1. No emergency / Not reported
2. General emergency
3. Lifeguard/medical
4. Minimum fuel
5. No communications
6. Unlawful interference
7. ~~Spare~~Downed Aircraft
8. Spare

Changes to section E.1 of Appendix E:

E.1 Improved Search and Rescue

An ADS-B application and a suitable ADS-B avionics configuration designed for supporting search and rescue (SAR) operations is desired by a variety of users.~~may serve as an incentive for voluntary equipage for general aviation users. Note however that such a future capability would be subject to international standardization and regulatory action.~~ This alternative could provide far superior positioning information in emergency situations. Many aircraft system architectures are possible, but the basic idea is to (1) crash-harden those components of the ADS-B avionics that transmit and receive ADS-B messages; (2) include a source of battery power that would enable the system to issue position reports for a suitable period of time; and (3) add a capability to "tag" radiated ADS-B messages as originating from an ~~aircraft in distress~~downed aircraft (either pilot-selectable, or automatically via an acceleration-sensitive switch). This application could significantly reduce the mean time from mishap to the notification of search and rescue crews. This is an obvious benefit to the distressed pilot and passengers, but a collateral benefit is ~~better and more timely information~~more efficient and less costly search and rescue efforts.

This application does not require an extensive ground-based monitoring network to listen for ADS-B distress messages. Airborne aircraft, participating in the same ADS-B message exchanges as the ~~distressed~~ downed aircraft, would serve as listening posts. In fact, issuing such signals via ADS-B will make it more likely that such distress situations will be detected in a more timely fashion, because monitoring for them in the overflying aircraft creates no additional workload on the part of ~~the pilot~~overflying pilots.

Changes to section E.4 of Appendix E:

E.2 Airport Ground Vehicle and Aircraft Rescue and Fire Fighting (ARFF) Vehicle Operational Needs

Each year many accidents and incidents involving aircraft and vehicles on airports result in property damage, personal injury, and sometimes fatalities. ARFF vehicles are ~~special vehicular equipment~~ required at some airports for the purposes of quickly and effectively responding to aircraft accidents, incidents and other emergencies on and off the airport surface. In many cases, response time is critical to being able to save lives and property.

~~ARFF vehicles often operate on taxiways and runways. In the event of an accident/incident, these specialized vehicles may leave the airport property, going directly and via the quickest route to the site.~~ Since weather is a causal factor in many accidents, it is not uncommon that these ARFF operations are conducted during periods of reduced visibility, high winds, or at night. There have been cases where rescue vehicles have been unable to find the wreckage because of poor weather, night conditions, or incorrect or incomplete directions to an accident site. There have also been instances when aircraft have crashed in the immediate proximity of an airport and the wreckage went undetected for hours, even days. Occasionally, aircraft with an in-flight emergency request that ARFF equipment be called to "stand by" alongside a runway or taxiway. Under these conditions, especially at busy airports, ARFF vehicle operators often need help identifying the stricken aircraft while its on final approach, or knowing which aircraft to follow once the aircraft is on the ground.

Also, situational awareness is needed by these ARFF vehicles of other aircraft and vehicles operating on the airport surface~~, ideally with a message to these other vehicles to hold in position, so as not to create a further safety hazard~~. A ~~moving~~ map display in ARFF vehicles along with the position of the accident/incident is highly desirable. ADS-B could help ARFF operations identify ~~the~~ aircraft requesting emergency assistance and also provide the location of downed aircraft so that the ARFF crew can provide assistance as quickly as possible.

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	46
Submission Date	08/15/01
Status (open/closed/deferred)	Rev A - CLOSED
Last Action Date	01/23/02

Short Title for Change Issue:	Revise table 3-3 and 3-4 to better reflect range dependency of requirements rather than application dependency

MASPS Document Reference:		Originator Information:	
Entire document (y/n)	n	Name	Jonathan Hammer
Section number(s)	3	Phone	703-883-5209
Paragraph number(s)		E-mail	Jhammer@mitre.org
Table/Figure number(s)	Table 3-3, Table 3-4	Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
	DO-260/ED-102 1090 MHz Link MOPS Rev A
X	ASA MASPS
	TIS-B MASPS
	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
	Item identified during recent ADS-B development activities and operational evaluations
X	MASPS clarifications and correction item
X	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial	X	Clarity		Performance		Functional

Issue Description:

Table 3-3 and 3-4 were intended to list requirements acquisition and accuracy requirements primarily as a function of range. Instead, these table list applications as the primary delineating variable. Therefore the requirements as a function of range are not clear. The attached modification clarifies these tables.

Also, since our understanding and naming of applications has changed since the publication of DO-242, the applications cited in DO-242 in general are no longer meaningful and should be changed as per the attached tables.

Originator's proposed resolution:

See Attachment A for proposed changes to 3.2.3.1, where green highlighted and blue underlined text is proposed additions, and red highlighted text is proposed deletions.

Working Group 6 Deliberations:

August 30, 2001: This issue paper was reviewed at the August WG6 meeting. It was agreed this Issue Paper will be addressed in Revision A by implementing the MASPS changes proposed in Attachment A of this Issue Paper.

- The acceptance of this Issue Paper means IP03 must be closed since the MASPS changes for this Issue Paper's resolution make IP03 moot.
- While the changes to Table 3-4 are accepted as found in Attachment A, the resolution of IP35 will mean further changes to the Table and Note 7.

January 11, 2002: While working on a resolution to IP35, which requested Note 7 of Table 3-4 be ether deleted or modified, it was proposed that a new note be added to Table 3-4 now that it has been rearranged to stress the range-dependency of the requirements. This note would be cited in the 90 nmi column in the three boxes where 90 nmi is mentioned. The purpose of this note is to clarify the applications and airspace conditions for which the aircraft density requirements were developed for ranges where 40 nmi < R <= 90 nmi. The new note reads as follows: "Air-to-air ranges extending to 90 nmi are intended to support the application of Flight Path Deconfliction Planning, Cooperative Separation in Oceanic/Low Density En Route Airspace, as described in Section 2.2.2.4. "

Working Group 6 Final Resolution:

The final resolution for this IP and Issue Paper 35 are shown in Attachment A on the following pages.

3.2.3.1 Interactive Aircraft/Vehicle ADS-B Subsystems (Class A)

Functional capabilities of interactive aircraft/vehicle subsystems are indicated in the context diagram of Figure 3-4. These subsystems accept own-platform source data, exchange appropriate ADS-B messages with other interactive ADS-B System participants, and assemble ADS-B reports supporting own-platform applications. Such interactive aircraft subsystems, termed Class A subsystems, are further defined by equipage classification according to the provided user capability. The following types of Class A subsystems are defined (Table 3-1):

- Class A0: Supports minimum interactive capability for participants. Broadcast ADS-B messages are based upon own-platform source data. ADS-B messages received from other aircraft support generation of ADS-B reports ~~which~~ that are used by on-board applications (e.g., CDTI for aiding visual acquisition of other-aircraft tracks by the own-aircraft's air crew). This equipage class may also support interactive ground vehicle needs on the airport surface.
- Class A1 supports all class A0 functionality and additionally supports e.g., ADS-B ~~conflict avoidance~~airborne conflict management and other applications to ranges < 20 nmi. Class A1 is intended for operation in IFR designated airspace.
- Class A2: Supports all class A1 functionality and additionally provides extended range to 40 nmi and information processing to support ~~optimized separation~~ longer range applications, e.g., oceanic climb to co-altitude. This service requires the broadcast and receipt of trajectory change point data (TCP).
- Class A3: Supports all class A2 functionality and ~~additionally~~ has additional range capability out to 90 nmi, supporting, e.g., ~~supports flight path de-confliction~~long range airborne conflict management. ~~Class A3 subsystems support longer look-ahead times with longer operational ranges than class A2~~. Class A3 has the ability to broadcast and receive strategic planning information such as future trajectory change point data (TCP+1).

Table 3-1 Subsystem Classes and Their Features

Class	Subsystem	Example Applications	Features	Comments
Interactive Aircraft/Vehicle Participant Subsystems (Class A)				
A0	Minimum Interactive Aircraft/Vehicle	Enhanced visual acquisition, conflict detection	Lower Tx power and less sensitive Rx than Class A1 permitted.	Minimum interactive capability with CDTI.
A1	Basic Interactive Aircraft	A0 plus Airborne Conflict management, station keeping	Standard Tx and Rx	Provides ADS-B based conflict avoidance and interface to current TCAS surveillance algorithms/ display
A2	Enhanced Interactive Aircraft	A1 plus Merging, conflict management, in-trail climb	Standard Tx power and more sensitive Rx. Interface with avionics source required for TCP data.	Baseline for separation management employing intent information.
A3	Extended Interactive Aircraft	A2 plus long range conflict management	Higher Tx power and more sensitive Rx. Interface with avionics source required for TCP and TCP+1 data	Extends planning horizon for strategic separation employing intent information.
Broadcast-Only Participant Subsystems (Class B)				
B1	Aircraft Broadcast only	Supports A1 applications for other participants	Tx pwr may be matched to coverage needs. NAV input required.	Enables aircraft to be seen by Class A and Class C users.
B2	Ground vehicle Broadcast only	Supports airport surface situational awareness	Tx pwr matched to surface coverage needs. High accuracy NAV input required.	Enables vehicle to be seen by Class A and Class C users.
B3	Fixed obstruction	Supports visual acquisition and airborne conflict management	Fixed coordinates. No NAV input required. Collocation with obstruction not required with appropriate broadcast coverage.	Enables NAV hazard to be detected by Class A users
Ground Receive Subsystems (Class C)				
C1	ATS En route and Terminal Area Operations	Supports ATS cooperative surveillance	Requires ATS certification and interface to ATS sensor fusion system.	En route coverage out to 200 nmi. Terminal coverage out to 60 nmi.
C2	ATS Parallel Runway and Surface Operation	Supports ATS cooperative surveillance	Requires ATS certification and interface to ATS sensor fusion system.	Approach coverage out to 10 nmi. Surface coverage out to 5 nmi.
C3	Flight Following Surveillance	Supports private user operations planning and flight following	Does not require ATS interface. Certification requirements determined by user application.	Coverage determined by application.

Table 3-3(a) Interactive Aircraft/Vehicle Equipage Type Operational Capabilities

Domain ->	Terminal, En-route, Oceanic										Approach		Airport Surface	
Equipage Class | V	Data Reqd to Support Operational Capability | V		(R<=10 nmi), eg, Conflict detection, Enhanced visual Acquisition		(R<=20 nmi),e.g., Airborne Conflict management, station keeping		(R<=40 nmi), e.g., Merging, conflict management, in-trail climb		(R<=90 nmi), e.g., Long range conflict management		(R<=10 nmi), e.g., AILS, paired approach		(R<=5 nmi), e.g., Airport Surface Situation Awareness	
	Tx	Rx	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form
A0 Minimum R=10 nmi	SV MS-P	SV	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes
A1 Basic R=20 nmi	SV MS-P	SV MS-P	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
A2 Enhanced R=40 nmi	SV MS	SV MS	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
A3 Extended R=90 nmi	SV MS OC	SV Ms OC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: SV= State Vector; MS-P= (Partial) Mode-status w/o TCP; MS= Mode-status w/TCP; OC= On Condition with TCP+1

* Operation in airspace with high closure rates may require longer range.

** Class A2 and A3 users may equip for low visibility taxi following.

Table 3-3(b) Broadcast and Receive Only Equipage Type Operational Capabilities

	Domain ->		Terminal, En-route, Oceanic								Approach		Airport Surface	
Equipage Class | V	Data Reqd to Support Operational Capability | V		(R<=10 nmi), eg, Conflict detection, Enhanced visual Acquisition		(R<=20 nmi),e.g., Airborne Conflict management, station keeping		(R<=40 nmi), e.g., Merging, conflict management, in-trail climb		(R<=90 nmi), e.g., Long range conflict management		(R<=10 nmi), e.g., AILS, paired approach		(R<=5 nmi), e.g., Airport Surface Situation Awareness	
	Tx	Rx	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form	Sup-port	Per-form
B1 Aircraft	SV MS-P	No	Yes	No	Yes	No	No	No	No	No	No	No	Yes	No
B2 Gnd Vehicle	SV MS-P	No	Yes	No	Yes	No	No	No	No	No	No	No	Yes	No
B3 Fixed Obstruction	SV MS-P	No	Yes	No	Yes	No	No	No	No	No	No	No	Yes	No
C1 ATS En route & Terminal	No	SV MS OC	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No
C2 Approach & Surface	No	SV MS OC	No	Yes	No	Yes	No	No	No	No	No	Yes	No	Yes
C3 Flight Following	No	SV MS OC	No	Yes	No	No	No	No	No	No	No	No	No	No

Notes: SV= State Vector; MS-P = (Partial) Mode-status w/o TCP; MS= Mode-status w/TCP; OC= On Condition with TCP+1

(Changes for IP35 are shown in yellow highlight.)
(Changes for IP46 are shown in green and light blue highlights.)

Table 3-4 ADS-B Report Accuracy, Update Period, and Acquisition Range Requirements

Operational Domain	Terminal, En-route, Oceanic				Approach	Airport Surface (note 5)
Applicable Range	R<= 10 nmi	R>10 nmi R<=20 nmi	R>20 nmi R<= 40 nmi	R>40 nmi R<=90 nmi	(R<=10 nmi)	(R<=5 nmi)
Equipage Class	A0-A3 B1-B3	A0-A3 B1-B3	A2-A3	A3	A1-A3	A0-A3 B1-B3
Example Applications	Conflict detection, Enhanced visual Acquisition	Airborne Conflict management, station keeping	Merging, conflict management, in-trail climb	Long range conflict management	AILS, paired approach	Surface situational awareness
Required State Vector Acquisition Range	10 nmi	20 nmi	40 nmi	90 nmi (notes 3, 14) (120 nmi desired)	10 nmi	5 nmi
Required Mode-status Acquisition Range (note 8)	10 nmi	20 nmi	40 nmi	90 nmi (notes 3, 14) (120 nmi desired)	10 nmi	5 nmi
Required On Condition Acquisition Range (note 8)	n/a	n/a	n/a	90 nmi (notes 3, 14) (120 nmi desired)	10 nmi	TBD
Required Nominal Update Period (95th percentile) (note 6) ~~(note 7)~~	<= 3 s (3 nmi) <= 5 s (10 nmi) (note 7)	<= 5 s (10 nmi) (1 s desired, note 2) <= 7 s (20 nmi)	<= 7 s (20 nmi) <= 12 s (40 nmi)	<= 12 s	<= 1.5 s (1000 ft runway separation) <= 3 s (1s desired) (2500 ft runway separation)	<= 1.5 s
Required 99th Percentile State Vector Report Received Update Period (Coast Interval) (Note ~~7,~~ 8)	<= 6s (3 nmi) <= 10 s (10 nmi) (note 7)	<= 10 s (10 nmi) <= 14 s (20 nmi)	<= 14 s (20 nmi) <= 24 s (40 nmi)	<= 24 s	<= 3s (1000 ft runway separation) (1s desired, note 2) <= 7s (2500 ft runway separation)	<= 3 s
Example Permitted Total State Vector Errors Required To Support Application (1 sigma, 1D)	σ_{hp} = 200 m σ_{hv} = n/a σ_{vp} = 32 ft σ_{vv} = 1 fps	σ_{hp} = 20 / 50 m (note 1) σ_{hv} = 0.6/ 0.75 m/s (note 1) σ_{vp} = 32 ft σ_{vv} = 1 fps	σ_{hp} = = 20 / 50 m (note 1) σ_{hv} = 0.3/ 0.75 m/s (note 1) σ_{vp} = 32 ft σ_{vv} = 1 fps	σ_{hp} = 200 m σ_{hv} = 5 m/s σ_{vp} = 32 ft σ_{vv} = 1 fps	σ_{hp} = 20 m σ_{hv} = 0.3 m/s σ_{vp} = 32 ft σ_{vv} = 1 fps	σ_{hp} = 2.5 m (note 9) σ_{hv} = 0.3 m/sσ σ_{vp} = n/a σ_{vv} = n/a
Required maximum error contribution due to ADS-B (1 sigma, 1D) (Note 10)	σ_{hp} = 20 m σ_{hv} = 0.25 m/s σ_{vp} = 30 ft σ_{vv} = 1 fps (Note 11)					σ_{hp} = 2.5 m (note 9) σ_{hv} = 0.25 m/s σ_{vp} = n/a σ_{vv} = n/a

Definitions:
σ_{hp}: standard deviation of horizontal position error.
σ_{hv}: standard deviation of horizontal velocity error.
σ_{vp}: standard deviation of vertical position error.
σ_{vv}: standard deviation of vertical velocity error.

Notes:

1. *The lower number represents the desired accuracy for best operational performance and maximum advantage of ADS-B. The higher number, representative of GPS standard positioning service, represents an acceptable level of ADS-B performance, when combined with barometric altimeter.*

2. *The analysis in Appendix J indicates that a 3-second report received update period for the full state vector will yield improvements in both safety and alert rate relative to TCAS II, which does not measure velocity. Further improvement in these measures can be achieved by providing a one-second report received update rate Further definition of ADS-B based separation and conflict avoidance system(s) may result in refinements to the values in the Table.*

3. *The 90 nmi range requirement applies in the forward direction. The required range aft is 30 nmi (40 nmi desired). The required range 90 degrees to port and starboard is 45 nmi (60 nmi desired) (see Appendix H).*

4. *n/a = not applicable; TBD = To be defined*

5. *Requirements apply to both aircraft and vehicles.*

6. *Supporting analyses for update period and update probability are provided in Appendices J and L.*

7 *Requirements for applications for ranges less than 10 nmi are under development. The 3 second update requirement is the minimum update period required to support ACM for aircraft pairs within 3 nmi and 6000 feet vertical separation that are converging at a rate of greater than 500 feet per minute vertically or greater than 6000 feet per minute laterally. Update rate requirements are once per 5 seconds (95%) for aircraft pairs that are not within these geometrical constraints, such as aircraft pairs that are diverging. Requirements for future applications, however, may differ from these requirements.*

8. *The delay for MS or OC report updates after a MS or OC state change should be no more than the coast interval associated with the state vector report (with 95% confidence).*

9. *The position accuracy requirement for aircraft on the airport surface is stated with respect to the certified navigation center of the aircraft.*

10. *This row represents the allowable contribution to total state vector error from ADS-B.*

11. *The horizontal velocity error requirements to aircraft speeds of up to 600 knots. Accuracies required for velocities above 600 knots are TBD.*

12. *Specific system parameter requirements in Table 3-4 can be waived provided that the system designer shows that the application design goals stated in Appendix J or equivalent system level performance can be achieved.*

13. *Update periods for the SV have been emphasized in determining link related performance requirements in this table. Lower rates of MS and OC are under development. These reports should be made available to support the operational capabilities using considerations*

equivalent to the SV. The requirement should be optimized to ensure that the refresh/update of reports is appropriate for the equipment classes and the operations being supported. Refer to the analysis presented in Appendix L for further details.

14. *Air-to-air ranges extending to 90 nmi are intended to support the application of Flight Path Deconfliction Planning, Cooperative Separation in Oceanic/Low Density En Route Airspace, as described in Section 2.2.2.4.*

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	47
Submission Date	08/15/01
Status (open/closed/deferred)	Rev. A - CLOSED
Last Action Date	08/30/01

Short Title for Change Issue:	Add approach spacing intent information as an additional example in appendix M.

MASPS Document Reference:		Originator Information:	
Entire document (y/n)	n	Name	Jonathan Hammer
Section number(s)	Appendix M	Phone	703-883-5209
Paragraph number(s)	M.3	E-mail	Jhammer@mitre.org
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
X	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
X	Has initial validation via operational test/evaluation
X	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
X	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:	X	Editorial		Clarity		Performance	X	Functional

Issue Description:

As requirements have begun to mature for approach spacing applications, it will be useful to add to the appendix M some possible additional information requirements. As appendix M is non-normative, this provides guidance information for manufacturers and does not affect requirements.

Originator's proposed resolution if any:

Add the follow new section to Appendix M:

(see next page)

Originator's proposed resolution (continued):

M.3 On Condition Report for Advanced Approach Spacing Operations

The advanced approach spacing operation on condition report contains information regarding planned speeds and ranges from the threshold for final approach. The update rate for this report is TBD.

The final approach speed is entered manually by the flight crew. All other entries are derived by the approach spacing algorithm.

Table M-3 Advanced Approach Spacing On-Condition Report Definition

Element	Contents
1	Participant Address (Section 2.1.2.1.2)
2	Planned final approach air-speed (knots)
3	Planned final approach deceleration range (from threshold) (ft)
4	Number of additional planned speed changes
5	Planned deceleration range 1 (last deceleration before deceleration to final approach speed)
6	Planned air speed after deceleration range 1
7	Planned deceleration range 2
8	Planned air speed after deceleration range 2
. . .	. . .
	Planned deceleration range N
	Planned air speed after deceleration range N

Working Group 6 Deliberations:

August 30, 2001: This Issue Paper was reviewed at the August WG6 meeting. It was agreed this Issue Paper will be addressed in Revision A by included the new section to Appendix M found in the proposed resolution for this Issue Paper.